"Synchrotron X-ray imaging and spectrometry of tissues"

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The first part of the talk describes the investigation of human brain cancers with X-rays. This research project was realized jointly by the AGH University and the Jagiellonian University Medical College in Krakow, Poland. The experimental work was performed between 2009-2015 at synchrotron beamlines at DORIS III, PETRA III, Diamond and the ESRF. A local μm-scale analysis and mm-range probes were used to determine the element composition of brain tissues and the oxidation states of trace metals involved in the pathogenesis. The synergy of statistical methods and X-ray fluorescence μ-spectrometry was used to construct a brain cancer classifier to distinguish between different cancer types and malignancy grades.

The second part of the talk deals with a cryogenic-vacuum environment for bio-imaging. This instrument is a home-made development and it was commissioned between 2013-2015 at the P06 hard X-rays μ/nano probe at PETRA III. The system allows 2D mapping and tomography with element and absorption contrasts. Results of commissioning based on model plant tissues are reported. A pilot experiment on medical samples showed the structure of granular layer in a human cerebellar tissue.

Finally, as the third part of the talk, a new instrument operated by the IAEA at XRF beamline at Elettra Sincrotrone Trieste is discussed. The experimental station was inaugurated in 2014, however a further commissioning alternates with users' operation. The station allows X-ray spectrometry in different experimental geometries. Analytical capabilities and exemplary applications are demonstrated.